

DANGEROUS TREE ASSESSOR'S COURSE



Wildland Fire Safety Module

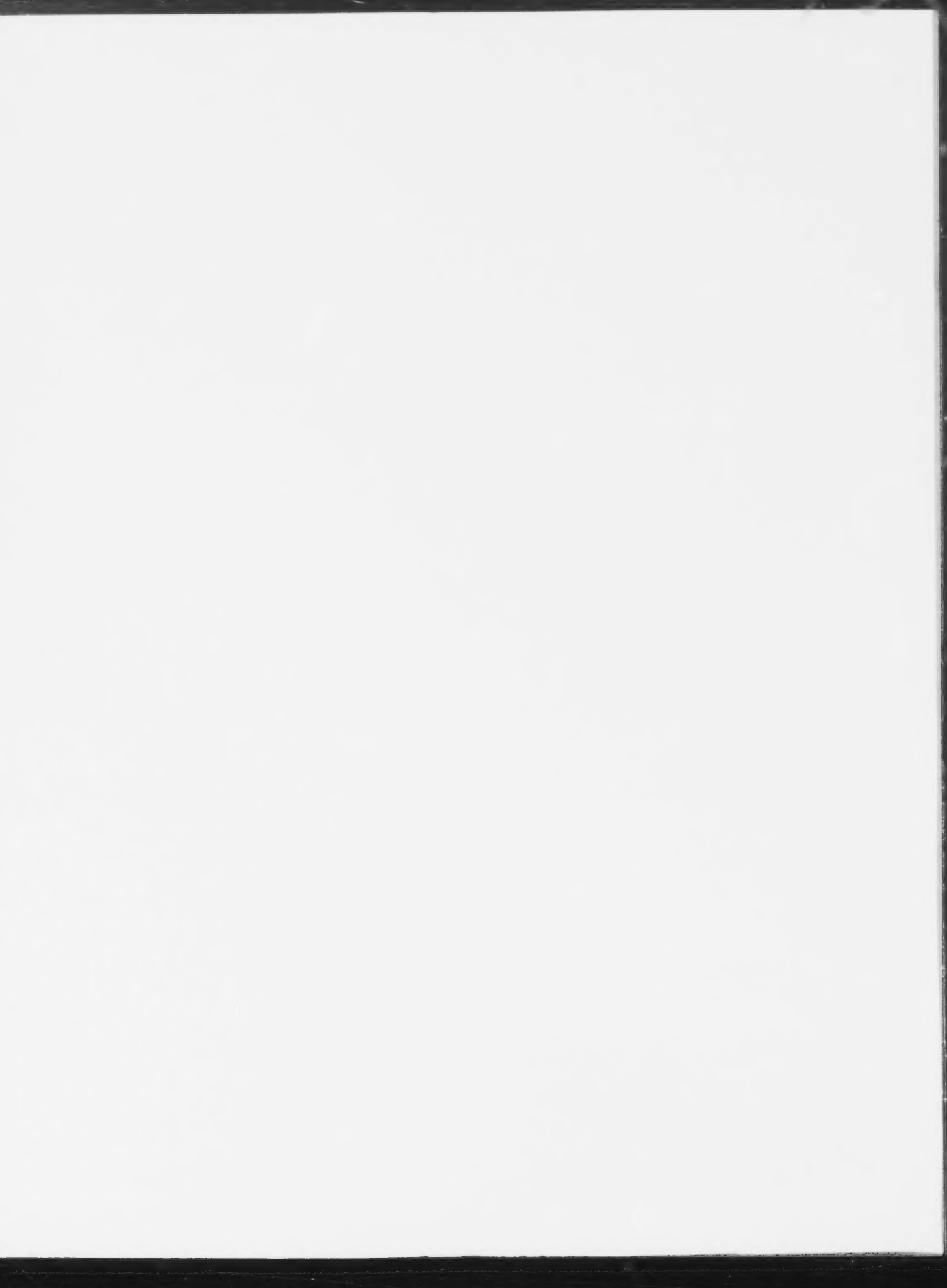


BRITISH
COLUMBIA

Ministry of Water, Land and
Air Protection

WorkSafe bc.com

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FOREWORD

This training course provides information and technical procedures for assessing tree hazards and establishing appropriate safe work practices in situations where there is potential exposure to workers involved in wildland fire fighting, from dangerous trees. It also provides information on habitat quality which can be used to retain some high-value wildlife trees where opportunities exist to assess both tree hazards and wildlife tree habitat value (e.g., in sustained action fires where there is sufficient time to assess wildlife tree habitat components).

Fire crews involved in wildland fire fighting do not have the time to complete a detailed tree assessment to determine if trees that appear dangerous might actually be assessed as safe. Consequently, this course primarily focuses on worker safety and tree defects which can be visually inspected and rated as having "high defect failure potential."

Persons who wish to learn more about wildlife/danger tree assessments applicable to post-fire forestry activities (e.g., tree planting burned areas), should take this training module in conjunction with the regular "Wildlife/Danger Tree Assessor's Course for Forestry Operations."

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A variety of people contributed to the development of this training module. Thanks are extended to the Wildlife Tree Committee of British Columbia (WTC) for permission to use some materials and concepts adapted from the "Wildlife/Danger Tree Assessor's Course – Forest Harvesting and Silviculture." Mel Dunleavy and Steve Bachop (Ministry of Forests, Protection Branch) were instrumental in their support throughout the development and revision of this module.

Additional review comments were received from various Ministry of Forests protection staff. Specific thanks are extended to Neil Campbell (Wildfire Ltd.), Doug Ellis (Malaspina University College), Fred Marshall (Marshall Forestry Services), Bruce Morrow (Sage Forestry), and Phil Ranson (Ministry of Forests Protection) for their valuable contributions to this current course workbook. Todd Manning (Manning, Cooper and Associates) compiled and edited this document and revised the training materials.

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WHAT IS A DANGEROUS TREE?

In the past, the term "snag" has been synonymous with "dangerous tree" and was historically defined in forestry operations as:

a standing dead or dying tree over 3 metres in height

However, live trees may have features that could be hazardous to workers. Consequently, the term "snag" has been replaced with "dangerous tree."

The following interpretation of "dangerous tree" now applies:

A DANGEROUS TREE...

...is any tree (regardless of its size) that is hazardous to people or facilities because of:

- *location or lean*
- *physical damage*
- *overhead hazards*
- *deterioration of limbs, stem or root system*
- *a combination of the above.*

With reference to dangerous trees and the work place, Workers' Compensation Board regulation 26.11 (1) states:

If work in a forestry operation will expose a worker to a dangerous tree, the tree must be removed.

This regulation applies to all workers who might have exposure to a dangerous tree.

Exposure is not limited to the active work area, but also includes the perimeter of the work (within 1 tree length or greater depending on site factors such as slope), as well as other locations such as rest areas and staging areas. (See Glossary for definition of work area.)

The procedures for determining whether a tree is dangerous to workers under various levels of disturbance, and the appropriate steps and safety procedures for mitigating the hazard, are described in the following sections.

WHAT IS A WILDLIFE TREE?

Trees in various stages of life, death and decay are important components of the structure and function of all natural forest ecosystems. Wildlife trees are part of this cycle of life and death. They are constantly being formed by biotic and abiotic factors such as insects, fungi, fire and weather.

A wildlife tree is any standing dead or live tree with special characteristics that provide valuable habitat for the conservation or enhancement of wildlife.

In British Columbia, 80 species of birds, mammals and amphibians depend on wildlife trees for nesting, feeding and shelter. Some wildlife trees are protected under Section 34 of the provincial *Wildlife Act*, which reads as follows:

"A person who, except as provided by regulation, possesses, takes, injures, molests or destroys

(a) a bird or its egg,

(b) the nest of an eagle, peregrine falcon, gyrfalcon, osprey, heron or burrowing owl, or

(c) the nest of a bird not referred to in paragraph (b) when the nest is occupied by a bird or its egg

commits an offence."

Depending on their cause of death, specific tree defects and condition, and the type of work activity, some wildlife trees can be dangerous. A discussion of tree danger rating is found in the upcoming sections. More information on wildlife tree habitat value is found in Appendix 1.



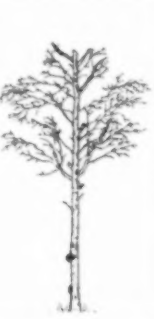
Bat roost in cedar snag
Photo courtesy of Province of British Columbia

TREE CLASS COMPARISON FOR CONIFERS AND HARDWOOD TREES

The following tree decay class diagrams illustrate the general breakage and decay patterns seen in coniferous and deciduous trees. The six step hardwood classification system (broad-leaved deciduous trees) is parallel to the coniferous scheme, but is more accelerated in the middle and latter classes. Both systems are used in this workbook to provide information for rating trees for defect failure potential and ecological habitat value. A detailed description of class 2 trees is found in Appendix 1 (p. 1-6).

	Live		Dead					Dead Fallen	
Conifers	1	2	3	4	5	6	7	8	9
Hardwoods	1	2	3	4		5			6

Tree class	LIVE		DEAD						DEAD FALLEN
			Hard			Spongy	Soft		
	1	2	3	4	5	6	7	8	9
									
Description	Live/healthy; no decay or structural damage	Live/unhealthy; internal decay or growth deformities or other structural damage (including stem damage, dead or broken tops); dying tree	Dead; recently dead; needles or fine twigs present.	Dead; no needles/twigs; 50% of branches lost, only larger limbs remain, often loose bark.	Dead; most branches/bark absent; some internal decay.	Dead; very little branches or bark; sapwood/heartwood may be sloughing from upper bole; decay more advanced; lateral roots of larger trees usually softening.	Dead; extensive internal decay, outer shell may be hard, lateral roots usually completely decomposed, hollow or nearly hollow shells.		Debris; downed trees or stumps.

Tree class	LIVE		DEAD			DEAD FALLEN
	1	2	3	4	5	6
						

WHEN TO CONDUCT VISUAL TREE INSPECTIONS (also refer to Steps 1–4 on the following pages)

- at the time of the initial on-the-ground fire assessment
- prior to any workers entering the area to commence on-the-ground fire suppression
- if, since the previous assessment, BUI values are above thresholds AND there is continuous burning
- if more than three days have passed since the previous assessment
- if work activities recommence after the previous assessment and work activities had been completed
- if the level of disturbance is different from the initial intended work activity
- conduct tree inspections to the highest disturbance level (i.e., work activity) you expect to attain on site
- tree inspections need only be conducted on trees which are visually "suspect" (i.e., they are damaged or potentially dangerous).

DETERMINING TREE DANGER RATING

There are four steps required to determine tree danger rating:

- STEP 1 Determine level of ground or tree disturbance [1, 2, 3, 4] and type of work activity.** See Table 1.
- STEP 2 Conduct site assessment overview.** Look for site factors which suggest tree decline or potential tree failure. Refer to Table 2.
- STEP 3 Conduct visual tree inspection.** Assess the tree(s) for visual hazard indicators (see tables 3, 3A and 3B). If the root condition is suspect (i.e., the roots have been burned into, severed or uplifted), a shallow root excavation with a Pulaski may be necessary.
- STEP 4 Make the appropriate safety decision** (either Safe or Dangerous).
- STEP 5 Provide Documentation** of assessed trees and assessed areas (includes date, location, level of disturbance, marking procedures and how danger trees have been managed).

STEP 1

Level of Disturbance

Various work activities are associated with differing levels of disturbance. Activities rated as very low risk (VLR) or low (1) disturbance create negligible ground or tree disturbance and as a result, expose workers to very little danger. However, as the level of disturbance increases, so does the potential danger. As a result, fewer activities are appropriate around potentially dangerous trees under situations of higher ground or tree disturbance. Table 1 relates level of disturbance with various work activities.

*Table 1. Levels of disturbance for unprotected workers in various fire-related work activities**

Level of Disturbance (LOD)	Type of Work Activity
Very Low Risk (VLR) *	• surveys • stand reconnaissance • tree marking, boundary marking • fire guard/control line layout • establishing hose lays in green (unburned) areas • burning off • road or trail travel with light vehicles (ATVs, pickups <5500 kg GVWR) in green (unburned) areas
1	• fire control and mop-up with hand tools and/or water hoses (manual activities only) • establishing hose lays in black (burned) areas • road or trail travel with light vehicles (ATVs, pickups <5500 kg GVWR) in black (burned) areas • road travel with heavy vehicles (>5500 kg GVWR) on ballasted and compacted roads (all areas) • tree bucking • slashing
2 and 3	• road travel with heavy vehicles (>5500 kg GVWR) on non-ballasted and non-compacted roads or trails (includes unguarded heavy equipment travel such as skidders) • tree falling • use of heavy mechanized equipment • use of light and intermediate helicopters where workers are exposed to rotorwash
4	• use of medium and heavy helicopters where workers are exposed to rotorwash • fire camps, fire bases • staging and marshalling areas

* NOTE Very Low Risk (VLR) activities usually result in negligible amounts of ground or tree disturbance and have very low exposure time to potential tree hazards. Consequently, the risk of injury or damage due to tree hazards is very low under these circumstances, and a formal dangerous tree assessment is NOT required. Workers should keep a "heads-up" and stay away from any obvious dangerous trees and overhead tree hazards (e.g., insecurely lodged trees; hanging tops or limbs).

Wind Influence

Workers must be aware of wind conditions and the influence of wind on tree stability. Strong winds increase the potential of trees failing. Potentially dangerous trees within reach of work areas must be removed or managed by a certified assessor who determines whether the tree is safe or dangerous, and manages it in accordance with the established practices. If wind conditions become strong enough (i.e., >65km/hr; winds set whole trees in motion and cause branches to break and fly in the air, walking is impeded by the wind), workers should consider leaving the work area and go to a safe refuge

Build-up Index (BUI)

The Build-up Index (BUI) represents a numerical rating for the amount of fuel available for combustion in the sub-surface layer located between forest litter (non-decomposed vegetation) and mineral soil (parent material, hardpan, rock). This fuel layer is more commonly known as organic soil and is where the roots of trees are located, seeking nutrients and moisture. The lack of moisture entering this layer over a period of time causes drying. This drying over time is represented by the BUI value. The higher the numerical rating, the drier the soil is. The drier the soil, the more the organic matter within it becomes available as fuel to wildfire. When more soil is consumed during a fire, the risk to tree instability increases. This instability may be caused by the burning of the root system itself, or the undermining of the anchoring soil layer which supports the roots. Either one can compromise worker safety. For this reason the BUI threshold values for various fuel types are used as an indicator of potential tree instability and hazard (see Table 2).

Different fuel types have different BUI threshold values. This is due to the relationship between soil condition (amount, depth, structure and moisture of organic layers), climate and tree species. Consequently, different forest soils have different fuel consumption rates (e.g., fires in spruce stands often burn away live roots as well as undermine the anchoring soil layer surrounding the near-surface "plate-root" system of spruces).

STEP 2

Table 2. Site Assessment Overview (for all tree species)

How to use this table: The following site/stand factors should be reviewed during a walk through of the site, prior to individual tree inspection. The site overview provides a context for inspection of individual trees (i.e., it will identify overall site problems such as damaged roots and soil condition, or windthrow hazard). Specific tree defect failure ratings are summarized in Table 3A.

Site/Stand Factors	Hazard Indicators/Influences														
Stand history and condition	- evidence of past tree failure - natural disturbance history (e.g., old burn, old root rot area) - stand age and structure - tree species composition - evidence of root and/or stem diseases - soil or slope instability - sites where air tanker or water scooper aerial drops have recently occurred - sites where blasting has recently occurred														
Flooding	- high water table - evidence of water damaged/decayed roots - area prone to flooding														
Windthrow potential	- topography (e.g., ridge crests) - prevailing winds (e.g., valley bottom outflows) - evidence of significant windthrow - area of high or recent exposure - stems with height/diameter ratio >90* - saturated soils - shallow soils - restricted rooting depth (clays, bedrock)														
Crown condition	- stress cone crop - thinning foliage - chlorosis - rounded crown - small live crown (<20%)* - crown imbalance (majority of branch weight on one side)														
Resinosis	higher than normal stem or basal pitch flow														
Tree lean	trees recently leaning due to windstorm, root damage, shifting root mat or other causes.														
Severity of fire/burn	build-up index (BUI) as per Fire Behaviour Prediction System (FPB) guide for fuel types <table border="1"> <thead> <tr> <th colspan="2">Canadian Forest Fire Danger Rating System</th></tr> <tr> <th>Fuel Type</th><th>BUI Threshold Value</th></tr> </thead> <tbody> <tr> <td>C-1</td><td>>40</td></tr> <tr> <td>C-2, C-3, C-4, C-5, C-6</td><td>>60</td></tr> <tr> <td>C-7</td><td>>80</td></tr> <tr> <td>D-1</td><td>>30</td></tr> <tr> <td>M-1, M-2, M-3, M-4</td><td>>40</td></tr> </tbody> </table>	Canadian Forest Fire Danger Rating System		Fuel Type	BUI Threshold Value	C-1	>40	C-2, C-3, C-4, C-5, C-6	>60	C-7	>80	D-1	>30	M-1, M-2, M-3, M-4	>40
Canadian Forest Fire Danger Rating System															
Fuel Type	BUI Threshold Value														
C-1	>40														
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C-7	>80														
D-1	>30														
M-1, M-2, M-3, M-4	>40														
Time since fire (the 3 day time frame should only be used as a cautionary indicator relative to assessment of site hazard)	- damage to major roots or anchoring soil layer affects tree stability - If Buildup Index Values are above the established thresholds and there is continuous active burning within the area of work - If more than three days with continuous burning have passed since the last assessment - Also consider the depth and degree of root damage(burning) in the area to be assessed.														

* Trees with small live crown proportions and low stem taper have poor crown balance. This can increase their blowdown/falldown hazard, especially if the rooting system is weak.

STEP 3

Visual Tree Inspection

The determination of tree safety/danger is generally a visual process. **Only trees which are considered by a certified assessor to be "suspect" or potentially dangerous after conducting "the site assessment overview" need a visual tree inspection.** Where visual inspection identifies questionable root stability, the tree would usually be rated as "high defect failure potential," and be considered dangerous, unless further probing with a hand tool indicates that the roots are sound. Careful observation of potential tree defects and hazards is required (see below for discussion).

Tree Hazards

A tree can be potentially dangerous if it has defects in its top, branches, stem or root system. The degree of hazard will vary with the size of the tree, type and location of the defect, the severity of any damage, the tree species, and nature of the work activity or target.

The danger tree assessment process requires that assessors identify tree hazards and know how to recognize, evaluate and manage for all types of hazards.

Live or Dead Tree Defects

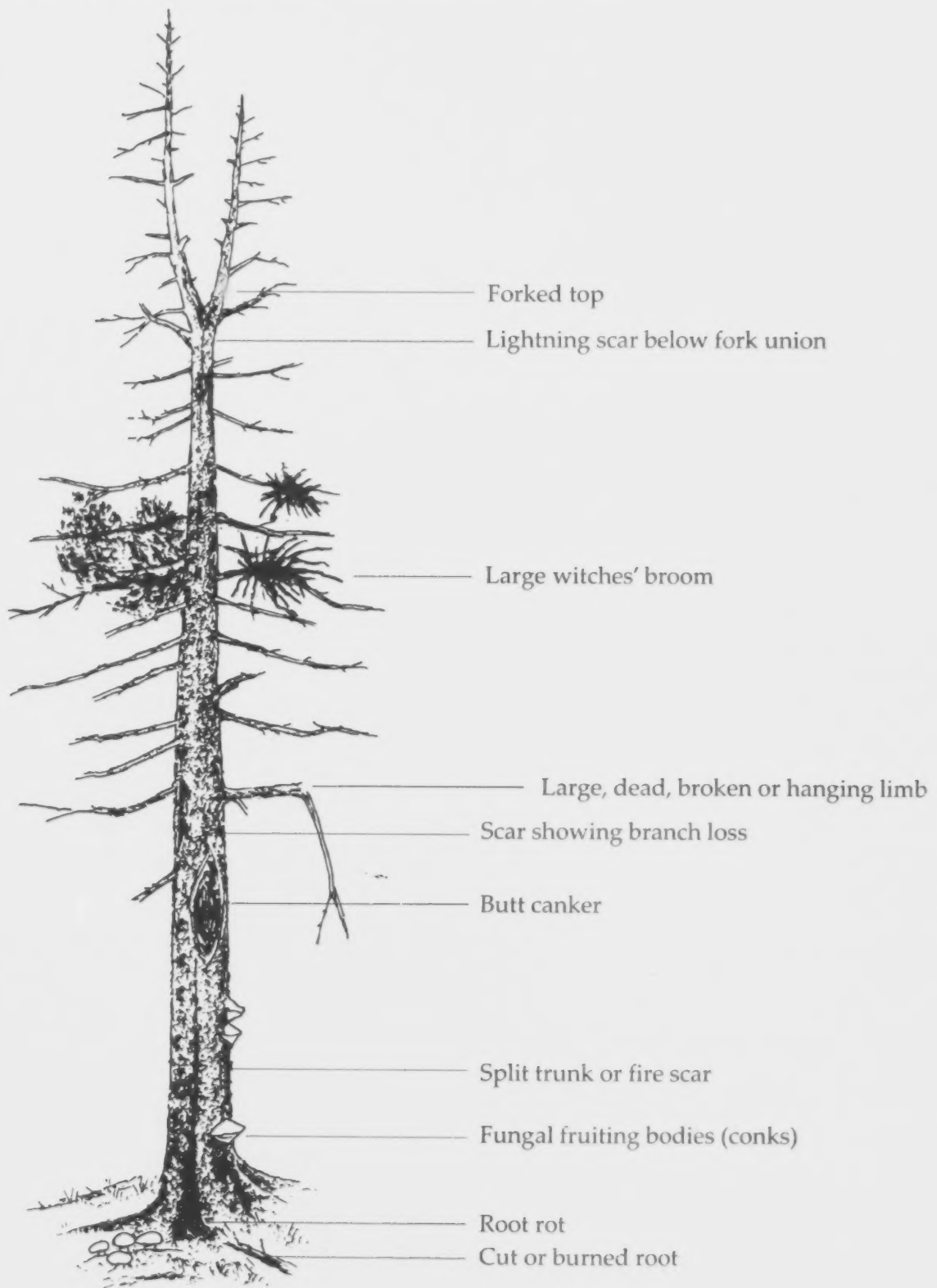
Tree defects can be separated into three categories: top and branch defects, stem defects, and root and butt defects.

Tables 3A and 3B provide a summary of high failure potential tree defects associated with live or dead trees. Trees with NO defects or only defects which fall below the high failure threshold, are often rated safe. However, see Step 4 for further safety procedure information.

On the following two pages are diagrams of the major tree defects.

Common Dangerous Tree Defects

Eight Generalized Tree Defects Which Influence Tree Failure



(for further description see Table 3A)

Dead limbs (DL)



Hazardous tops (HT)

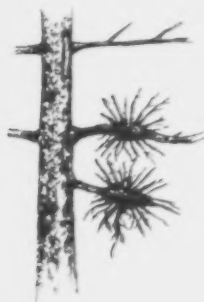


proportion of
tree height

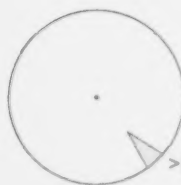


spike top that
resulted from an
old top breakage

Witches' broom (WB)



Split trunk (ST)



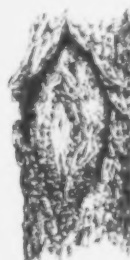
>2 cm width



Stem damage (scarring, fire damage, or butt rot) (SD)



Butt and stem cankers (CA)

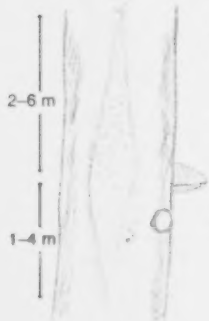


Fungal fruiting bodies (conks and mushrooms) (CM)*



* A list of common
tree pathogens
found in B.C. is
described in
Appendix 2.

Fungal decay columns



Column of heartrot decay
extending above and below
fungal fruiting body (conk).
General rule of thumb
—decay often extends 2–6
m above conk and 1–4 m
below. **Circular nest
cavities (NC)** are a good
indicator of heartrot decay
(drawing not to scale).

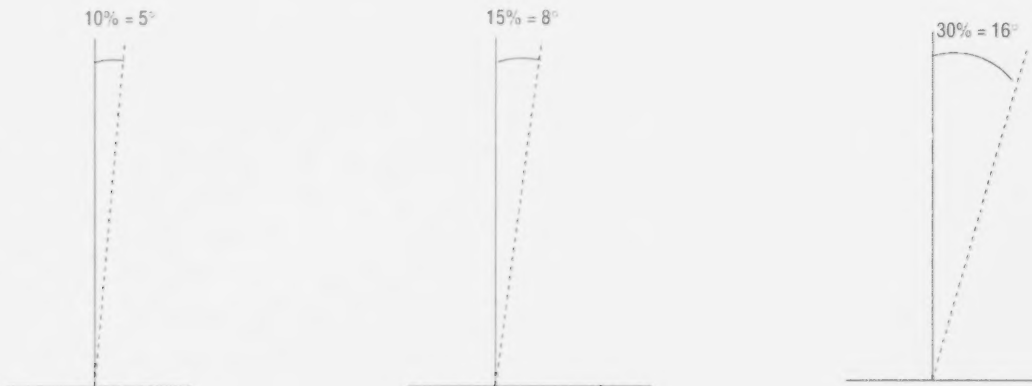
Thick sloughing bark (SB)



Tree lean and **root condition** must also be evaluated as part of the "Visual Inspection Process" (Step 3). Specific failure potential criteria for tree lean and root condition are described in Table 3A.

Tree Lean

Tree lean may be recent or long-standing. Dead trees and dangerous live trees that are leaning must be assessed for severe root and basal rot. Long-standing lean trees have often subsequently grown a vertical top in the time since the lean occurred. Live lean trees develop tension and compression wood at stress points, to aid in support. They also develop a reinforced root system, where disturbed, to compensate for prior damage. Unless the roots are disturbed further or decay is present, the potential for failure of long-standing leaning trees is low, and such trees need not be considered a hazard.



Recently-leaning trees are tilted over their entire length. Since there is no evidence of subsequent reinforcement of the root system or bole wood, assessors must assume hazard potential.

Assessors should also identify other rooting problems which can compound the effects of high tree lean. These include shallow roots or substrate, burned, damaged or decayed roots and/or lifted roots, burned or disturbed anchoring soil layers, or adjacent history of windthrow.

Leaning trees which are **securely lodged** in a large sound tree with no chance of breaking free, have negligible lean hazard. Leaning trees in this condition must be evaluated on an individual basis.

Sweep is defined as the curvature or distortion of the stem, and is often associated with competition for sunlight, snowpack and steep slope conditions. Sweep should not be confused with lean.

Slope is an important determinant of the direction of falling, and how far and with what force a tree will roll or slide after falling. Danger trees falling on slopes may travel farther than the length of the tree.



Root Condition (based on visual inspection)

Root condition should be assessed at the root collar (as close to the ground as possible).

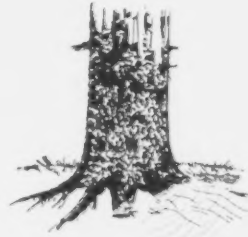
If **visual inspection indicates questionable root stability**, then a shallow root excavation and cautious chopping or probing into the roots with a Pulaski or other suitable hand tool should be done to expose the condition of the roots and to determine if the type of scheduled work activity will destabilize the tree.

Example 1:



This tree has 5 major lateral roots. Excavation with a Pulaski showed that 3 roots had decay and were unstable. The tree was assessed as dangerous.

Example 2:



Heavy equipment used during fire guard construction has severed the root system of this tree, resulting in more than 50% lateral roots damaged. This is a high defect failure potential, and the tree would be assessed as dangerous.

Trees with >50% of lateral roots **damaged, burned or decayed** have a **HIGH** failure potential rating (see Table 3A). This condition should not be confused with roots where the soil duff layer has been scraped or burned away — merely **exposing** the roots, not **damaging** them.

- Watch for root systems which have been **severely burned along with the supporting/anchoring soil layer**. These “popped” roots can be very unstable.
- Trees on **shallow soils over bedrock or hardpan**, or with high water tables, will have shallow root systems. Also look for **root pull and cracked or lifting soil mats**. They will become more hazardous over time and should be examined carefully before work commences.
- **Trees growing in or near areas where root disease is seen to be present** are likely to be diseased as well. Watch for stand openings associated with uprooted trees, standing trees with thin or discoloured crown foliage (chlorosis), and fruiting bodies of root disease-causing fungi near the base of trees.



Burned and severed roots — high failure potential. Tree felled.

Table 3 describes the **three significant tree hazards** which indicate a high failure potential and therefore a **Dangerous** rating for level 1 disturbance/work activities—lesser hazards can be rated Safe for level 1 activities. In most cases a site assessment overview **conducted by a qualified person** will be sufficient to identify the significant tree hazards for level 1 work activities.

Table 3. Danger Tree Assessment Process for Level 1 Disturbance Activities—Significant Hazard Indicators

D = dangerous	if tree has one or more of the following significant tree hazards: • insecurely lodged trees, or hung-up limbs or tops (consider size and height above ground) • highly decadent or unstable (e.g., >50% cross-section area stem damage, or >50% lateral roots damaged/unsound) • recent high lean (>15% toward work area) AND damaged root system/anchoring soil layer
S = safe	all other trees

NOTE

Tree defect descriptors that indicate a **DANGEROUS** tree rating are summarized in Table 3A. Use these tables to determine which trees are rated dangerous for levels 2 and 3 disturbance activities. Table 3B describes the only types of trees that are safe for retention in level 4 disturbance activities. The defects described in both these tables are those that would cause likely injury if they were to fail. Therefore, consider the size of the defect and its height above ground.

Table 3a. Dangerous Tree Criteria for Level 2 and 3 Disturbance Activities

NOTE: Any tree defects as described in the boxes below will be rated as DANGEROUS for level 2 and 3 disturbances. Trees with lesser defects can be rated SAFE for level 2 and 3 – take care to not brush trees if falling adjacent trees.

Defect Category	Species Group	
	Douglas-fir, larch, pines, spruces	Western redcedar, yellow cedar
Hazardous top (HT)	All tree classes: Dead top (any size) as spike, fork or multiple stems with structural weakness; OR • Class 4 and 5 trees: top as spike, fork or multiple stems >30% of tree height	All tree classes: Dead top (any size) as spike, V-shaped fork or multiple stems with structural weakness
Dead limbs (DL)	• Dead limbs >10 cm diameter with structural weakness • Cracked, decayed, broken or hung-up limbs	• Dead limbs >15 cm diameter with structural weakness • Cracked, decayed, broken or hung-up limbs
Witches' broom (WB)	Brooms >1 m diameter on live or dead branches AND evidence of decay, cracking or failure	n/a
Splittrunk (ST) (includes frost, lightning, wind- and impact-induced cracks)	Crack or split >2 cm wide extending >25% of tree diameter into stem AND evidence of decay in surrounding stemwood	Class 2 and 3 trees: Crack or split >2 cm wide extending >50% of tree diameter into stem AND evidence of decay in surrounding stemwood Class 4–8 trees: Crack or split >2 cm wide extending >25% of tree diameter into stem AND evidence of decay in surrounding stemwood
Stem damage (SD) (includes scarring, fire, machine, and animal damage or butt rot)	• >50% of tree cross-sectional area damaged, burned, scarred or fractured	• >50% of tree cross-sectional area damaged, burned, scarred or fractured
Thick sloughing bark or sloughing sapwood (SB) (bark applicable to Douglas-fir, larch, pond-erosa pine and cotton-wood >50 cm dbh)	Large pieces of bark or sapwood separated and sloughing from bole of tree	Bark n/a • Long slabs of sapwood hanging from bole of tree
Butt and stem cankers (CA)	>50% of butt or stem circumference as a perennial canker face*	n/a
Fungal fruiting bodies (CM)** (conks and mushrooms)	• Any heartrot fungus present Exception: For veteran and dominant trees, if <i>Phellinus pini</i> conks present BUT NO other visible defects/damage to stem that allow oxygen exchange (e.g., broken top, scarring, nest cavity, etc.) = SAFE; • Sap-rotting fungi present on any tree <30 cm dbh where saprot width is >5 cm	n/a
Tree lean (TL) (for class 1–3 trees)	Lean >15% toward target/work area AND tree has rooting problems (e.g., damaged roots; shallow, compacted or wet soils; cracked or lifting root mat; steep slope)	Lean >15% toward target/work area AND tree has rooting problems (e.g., damaged roots; shallow, compacted or wet soils; cracked or lifting root mat; steep slope) • For candelabra-branched trees, where candelabras are predominantly on lean side of tree—lean >10% toward target/work area and tree has rooting problems
Tree lean (TL) (for class 4–8 trees)	Lean >10% toward target/work area AND tree has rooting problems (e.g., damaged roots; shallow, compacted or wet soils; cracked or lifting root mat; steep slope)	Lean >10% toward target/work area AND tree has rooting problems (e.g., damaged roots; shallow, compacted or wet soils; cracked or lifting root mat; steep slope)
Root inspection	Occurrence of any of the following: root pull or lifting root mat; visible damage or decay to roots affects >50% of lateral roots	Occurrence of any of the following: root pull or lifting root mat; visible damage or decay to roots affects >50% of lateral roots

NOTE: Structural weakness includes decay, cracking, breakage, embedded bark or cracking at forks or multiple stem unions, presence of conks, stem scars, and woodpecker cavities. (NC)

**** Footnotes can be found on page 8 (on reverse).

Continued

Table 3a. Dangerous Tree Criteria for Level 2 and 3 Disturbance Activities (concluded)

NOTE: Any tree defects as described in the boxes below will be rated as DANGEROUS for level 2 and 3 disturbances. Trees with lesser defects can be rated SAFE for level 2 and 3 – take care to not brush these trees if falling adjacent trees.

Defect Category	Species Group	
	Hemlock, true firs	Broad-leaved deciduous
Hazardous top (HT)	All tree classes: Dead top (any size) as spike, fork or multiple stems with structural weakness ; OR Class 4 and 5 trees; top as spike, fork or multiple stems >20% of tree height	All tree classes: Dead top (any size) as fork, co-dominant or multiple stems with structural weakness; OR dead top >20% of tree height
Dead limbs (DL)	- Dead limbs >10 cm diameter with structural weakness - Cracked, decayed, broken or hung-up limbs	- Dead limbs >10 cm diameter with structural weakness - Cracked, decayed, broken or hung-up limbs
Witches' broom (WB)	Brooms >1 m diameter on live or dead branches AND evidence of decay, cracking or failure	n/a
Split trunk (ST) (includes frost, lightning, wind- and impact-induced cracks)	Crack or split >2 cm wide extending >25% of tree diameter into stem AND evidence of decay in surrounding stemwood	Crack or split >2 cm wide extending >25% of tree diameter into stem AND evidence of decay in surrounding stemwood
Stem damage (SD) (includes scarring, fire, machine, and animal damage or butt rot)	>50% of tree cross-sectional area damaged, burned, scarred or fractured	>25% of tree cross-sectional area damaged, burned, scarred or fractured
Thick sloughing bark or sloughing sapwood (SB) (bark applicable to Douglas-fir, larch, ponderosa pine and cottonwood >50 cm dbh)	n/a	Large pieces of bark separated and sloughing from bole of tree
Butt and stem cankers (CA)	n/a	>20% of butt or stem circumference as a perennial canker face* >50% of butt or stem circumference as a canker face on a dead tree
Fungal fruiting bodies (CM)** (conks and mushrooms)	Any heartrot fungi present; OR - Sap-rotting fungi present on trees <60 cm dbh where saprot width is >6 cm	Any heartrot fungi present*** OR - Sap-rotting fungi present on trees <60 cm dbh where saprot width is >6 cm
Tree lean (TL) (for class 1–3 trees)	Lean >15% toward target/work area AND tree has rooting problems (e.g., damaged roots; shallow, compacted or wet soils; cracked or lifting root mat; steep slope)	Lean >15% toward target/work area AND tree has rooting problems (e.g., damaged roots; shallow, compacted or wet soils; cracked or lifting root mat; steep slope)
Tree lean (TL) (for class 4–8 trees)	Lean >10% toward target/work area AND tree has rooting problems (e.g., damaged roots; shallow, compacted or wet soils; cracked or lifting root mat; steep slope)	Lean >10% toward target/work area AND tree has rooting problems (e.g., damaged roots; shallow, compacted or wet soils; cracked or lifting root mat; steep slope)
Root inspection	Occurrence of any of the following: root pull or lifting root mat; visible damage or decay to roots affects >50% of lateral roots	Occurrence of any of the following: root pull or lifting root mat; visible damage or decay to roots affects >50% of lateral roots.

NOTE: Structural weakness includes decay, cracking, breakage, embedded bark or cracking at forks or multiple stem unions, presence of conks, stem scars, and woodpecker cavities. (NC)

* Perennial cankers are generally circular to lens-shaped cankers that can persist for years, and slowly expand at about the same rate as the radial growth of the affected live tree. They gradually take on a sunken appearance as tissues under the dead cambium and do not grow along with the surrounding wood. They are sometimes called "exploding cankers."

** If identity of wood decay fungus cannot be determined (e.g., saprot or heartrot), then default to Dangerous rating. Where *Phellinus pini* is present, if the stem has structural damage such as a broken top or scarring which allow oxygen exchange or other stress indicators (e.g., resinosis, damaged roots), **OR** if there are conks distributed along the bole length, then default to Dangerous rating.

*** An alternate safe work procedure for dealing with fungal conks on live trembling aspen is described in the course workbook.

Table 3B. *Danger Tree Assessment Process for Level 4 Disturbance Activities*

When conducting level 4 disturbance assessments, only the following four types of trees are rated safe. All other trees will be rated Dangerous for level 4 activities.

Level 4 disturbance

S = Safe

if tree is one of the following:

- class 1 tree (all species)
- class 2 trees with NO structural defects (all species) (usually wind- or snow-snapped green trees, light fire scorching).
- class 2 **cedars** with LOW failure potential defects (refer to table at right)
- class 3 **conifers** with NO structural defects (tree recently killed by insects, climate or light intensity fire—no structural damage, decay or failure potential)

D = Dangerous all other trees
(fall tree; create a no-work zone;
or remove hazardous parts)

Any leave tree that is damaged during the work activity must be reassessed if work is to continue within reach of the tree.

CLASS 2 CEDAR TREES ARE SAFE IF THEY FIT THE FOLLOWING CRITERIA:

Defect Category	Western Redcedar, Yellow cedar LOW FAILURE POTENTIAL
Hazardous top (HT)	All tree classes: Dead top with spike, V-shaped fork or multiple stems <30% of tree height, with no evidence of decay, cracking, failure or other structural weakness
Dead limbs (DL)	Dead limbs <15 cm diameter with no evidence of decay, cracking or failure; OR Dead limbs (no size limit) on class 2 trees with no evidence of decay, cracking or failure
Split trunk (ST) (includes frost, lightning and wind-induced cracks; does not include dry checking)	Class 2 trees: Crack or split >2 cm wide extending <50% of tree diameter into stem; no evidence of decay in surrounding stemwood
Stem damage (SD) (includes scarring, fire damage, machine damage, animal damage or butt rot)	Class 2 trees: <50% of tree cross-sectional area damaged, scarred or fractured with no evidence of decay in remaining stemwood
Tree lean (for class 1 and 2 trees)	Lean <30° (16°) toward target/work area and tree has no rooting problems
Lean — candelabra branched trees (for class 1 and 2 trees) (where candelabras are predominantly on lean side of tree)	Lean <10° (5°) toward target/work area and tree has no rooting problems
Root inspection	No visible problems: no root pull or lifting root mat. Any visible structural damage to roots only affects <25% of lateral roots (remaining roots undamaged)

STEP 4

Safety Procedures

Tree assessed
as SAFE ("S")

- tree safe to work around, no removal or modification necessary
- mark tree as Safe (if required)
- if necessary prior to further work occurring on site, reassess tree at a later time as an "indicator" tree (i.e., indication of site-specific changes to tree hazard due to changes in fire conditions).

Trees assessed
as DANGEROUS "D"

- mark tree as Dangerous (if required)
- remove tree
- remove dangerous part of tree (e.g., hazardous limb)
- flagged no-work zone.
- use of spotters (see explanation below).

Areas marked as
no-work zones
(NWZ)

- these areas usually contain a high density of dangerous trees
- area (NWZ) boundaries must be flagged in the field
- document NWZ location and flagging procedures
- determine associated work activities adjacent to these areas.

Areas assessed
as safe

- these areas will have had a site assessment overview and will have been visually inspected by a qualified assessor for dangerous trees **before** any other work activities commence in that area
- all "suspect" or potentially dangerous trees will have been visually inspected and marked appropriately (see marking procedures below), and the necessary safety procedures implemented (e.g., danger trees have been removed or placed in suitable NWZs)
- areas which have been assessed as safe must have their locations clearly mapped and documented, and their boundaries identified and communicated to workers who will be on site. This includes describing the marking procedures for individual trees assessed as SAFE, or the location and flagging procedures used in no-work zones established around individual trees (these NWZs will usually only be for dangerous but very high habitat value trees)
- determine associated work activities adjacent to these areas.

Use of Spotters

The use of spotters to watch suspect or potentially dangerous trees in order to allow other workers to carry out fire suppression actions may be utilized as long as **this is for a short duration, there is no other practicable alternative safety procedure, and the work carried out is critical to controlling the fire.** If this practice is to be utilized, then it is essential that all workers on-site are aware of the procedures to be used and appropriate action required if a tree appears in any way to be posing a threat of injury to any workers on-site at that time. All procedures must be documented and placed on the appropriate incident file

STEP 5

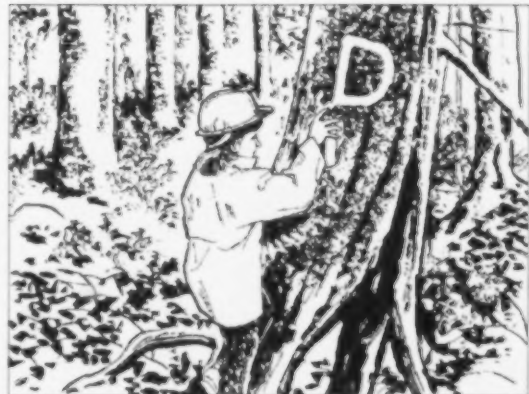
DOCUMENTATION

The certified tree assessor must document the following information on the FS 502c field card, or other retrievable format. Also refer to Appendix 4 for an example of assessment documentation.

- assessor's name
- date and time of assessment
- location of assessed area or trees (where appropriate this should be mapped to scale)
- marking protocol for individual trees assessed as "Safe" or "Dangerous" (i.e., paint or ribbon colour) (see page 18)
- location and method of identifying no-work zones (i.e., location mapped or described, and type of boundary flagging used)
- locations of areas assessed as safe (map or describe location and include relevant boundary flagging or tree marking procedures)
- level of disturbance/work activity the area was assessed for (e.g., road travel; workers in area using heavy equipment; tree falling; etc.)
- describe how the above information was communicated to appropriate personnel (i.e., develop a safety plan). The assessor must give a brief explanation/orientation to crews on site concerning the safety procedures associated with danger tree assessments (e.g., tree marking protocol, location of no-work zones, localities of areas assessed as safe).
- documentation must be available and retrievable (e.g., copied to fire file)
- documentation (data forms, maps of assessed area) must be forwarded to the Danger Tree Specialist once the assessment work has been completed for a given area. (i.e. on a daily basis)

MARKING OF TREES ASSESSED AS SAFE OR DANGEROUS

- Trees which have NO VISUAL HAZARD INDICATORS (e.g., trees with no structural damage or disease and no indication of other problems based on the site assessment overview) DO NOT have to be assessed nor marked. Only mark trees assessed as "Dangerous" or assessed as "Safe" suspect trees.
- Trees which are "suspect of hazards" and are then determined to be either "Dangerous" or "Safe" based on the site assessment overview and visual tree inspection may be marked in the field as follows:



- mark trees determined to be Dangerous with colour flagging, or by painting a large "D" on it or other suitable marking which must be documented and communicated to workers on site. The tree must then be removed or a **flagged** no-work zone established around it before workers enter this area.
- trees determined to be Safe may be marked by painting a large "S" on it or other suitable marking which must be documented and communicated to workers on site. These "SAFE" trees will include a tree that upon initial observation appears dangerous, but **after assessment** is found to be safe.
- If trees are spray marked either "D" or "S", this will be with fluorescent spray paint - blue or lime green recommended - at eye level on the tree with the letters large enough to be seen from 1½ tree lengths away from all directions.
- All flagging or paint colours which were used must be documented.
- Refer to Appendix 5 for suggested danger tree marking procedures.

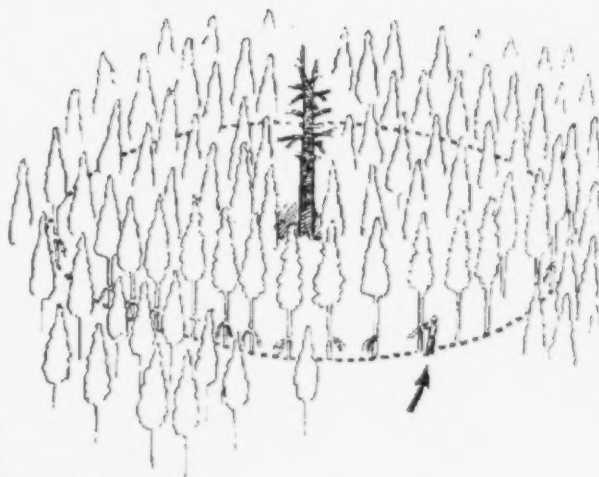
FLAGGING NO-WORK ZONES AROUND SINGLE TREES

No-work zones will generally only be installed around dangerous but high-value wildlife trees, or around trees too dangerous to fell. The assessor should ensure that all no-work zones are easily identifiable in the field, and their locations communicated to workers who may subsequently be in the area (see "Documentation" above).

Once the no-work zone has been calculated by the assessor, the area should be flagged.

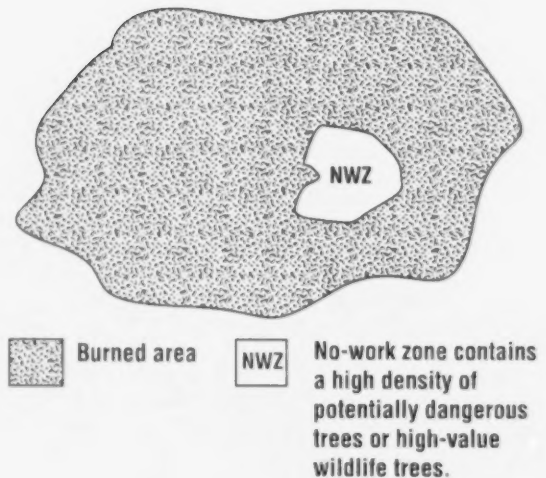
Flagging should be placed at sufficient intervals so that workers will always be able to see the NWZ boundary from any position along its perimeter. When necessary, flag the inside of the no-work zone with a second color tape to indicate the centre. This will indicate the orientation of the NWZ to workers.

For short duration and exposure fire situations (e.g., initial attack) NWZ boundaries must be clearly identified on site and documented. Flagging may not be necessary in these circumstances. No forest worker is allowed to enter the no-work zone except to remove a specific tree hazard to the work area (e.g., danger tree faller or guarded mechanical feller buncher enters zone to remove a dangerous tree along NWZ edge).



DELINEATING LARGER NO-WORK ZONE AREAS

- In wildfire burns with a high density of stems, where potentially hundreds or thousands of standing dead trees remain, it is not possible to assess each tree for potential safety hazards. In this circumstance, some areas may not be treated (e.g., mop-up activities) or will be treated at a later time or may contain numerous high-value wildlife trees. These areas should be delineated with "no-work zone" flagging or other physically identifiable boundary.
- Any dangerous trees along the edges of these no-work zones which can reach the work area, should be removed before work activities commence.
- No forest worker is allowed to enter the no-work zone except to remove a specific tree hazard to the work area (e.g., danger tree faller or guarded mechanical feller buncher enters zone to remove a dangerous tree along NWZ edge).
- The locations of no-work zones and no-work zone boundaries which have been flagged on the ground **MUST** be communicated to any workers who may subsequently be in the area.
- See documentation requirements on page 18.



GUIDELINES FOR KEEPING OR REMOVING DANGER TREES

- Fell all danger trees in main part of work area, and in and along access and evacuation trails. This includes trees marked "D" and any other trees which the faller (or machine operator) finds unsafe to the work area as a result of the falling process.
- Use qualified fallers.
- Use explosives or appropriate machinery, where necessary, to fell danger trees too dangerous for hand felling.
- If danger trees are too dangerous to fell safely, leave a no-work zone of appropriate size and shape around them.
- If felling danger trees will create excessive fuel loading and create fire control difficulties, assess if the area can be left and declared a no-work zone. This procedure must be discussed and approved with supervisor.
- Trees with high failure potential around work perimeters can be left provided they lean sufficiently away from the present work area and not into an adjacent work area.
- Remove danger trees above and below roads if they pose a potential hazard to road activity.
- Where possible, dangerous trees can be removed with adequately guarded machinery.

WORK PROCEDURES FOR ASSESSED AREAS

Once an area has been assessed, there is still work required before crews can be allowed to enter:

- Assuming that the assessor has found dangerous trees, a qualified danger tree faller must now cover the area. The faller must remove all trees marked as dangerous, except those that are retained within No Work Zones.
- The faller must be supplied with a map showing the relative location and numbers of trees to be felled. This map and numbers will ensure the faller does not miss any trees.
- The areas that are completed (assessed/felled/NWZs) must be included in the ongoing documentation for both large and small fires.
- The procedures for reassessment of areas/trees must also be followed depending on site conditions.

Also refer to Appendix 7 (Ministry of Forests Protection Branch Occupational Safe Work Standard #1) for additional information on dangerous tree assessment and related safety procedures.

REASSESSMENT OF TREES

- Reassessment of previously assessed trees should occur before workers enter the area:
 - if BUI values are above established thresholds AND there is continuous active burning within the area of work
 - if more than 3 days with continuous burning have passed since the last assessment
 - if work activity in the area creates more disturbance than what the area was originally assessed for
- If an area is reassessed, any tree previously marked as safe, but which after some time is now determined to be dangerous (e.g., because of a smoldering fire burning the roots), shall then have an "X" sprayed over the "S" and be marked with a "D." It should then be removed or a no-work zone established around it.
- Assessments in green (unburned) areas outside of the active fire area need only be done once for the appropriate level of disturbance (work activity)

NO-WORK ZONES (NWZ)

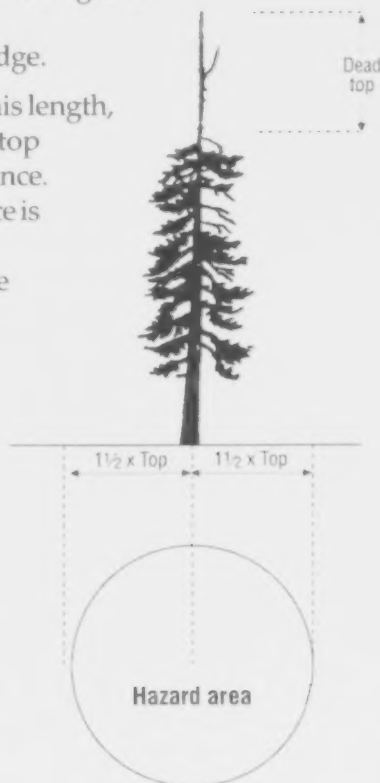
- The purpose of NWZs is to keep workers out of this area. Only the perimeter of the NWZ, if it is adjacent to an active work area, needs to be assessed for additional tree hazards.
- When the decision has been made to retain a tree that has been assessed as dangerous to workers, a no-work zone must be designated. This includes high-value wildlife trees which have been assessed as dangerous. The no-work zone must include all the area on the ground that could be reached by any dislodged portion of the tree.
- No-work zones will take into account the nature of the hazard and the lean of the tree.
- On steep ground, the no-work zone will be extended downhill to protect workers.
- A kick-back area should be included for semicircular no-work zones. The size and shape of this area is determined by tree lean, condition and form (branching).

Note: The size of NWZs is 1.5 times the defect length. This length can be modified (larger or smaller) depending on site-specific conditions.

The following are the most common types of no-work zones:

A. Sound tree, no lean, hazardous top, flat ground

1. Determine the length of top that might dislodge.
2. Add $\frac{1}{2}$ of this length, to get a $1\frac{1}{2}$ top length distance. This distance is the radius of the no-work zone.



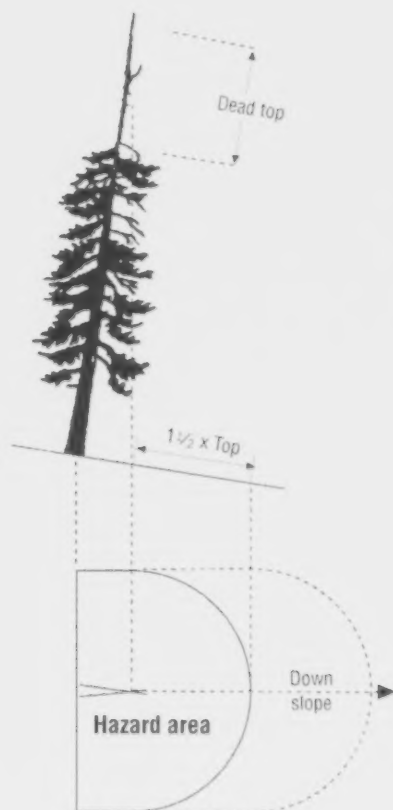
B. Sound tree with lean, hazardous top, flat ground

1. Determine the length of top that might dislodge.
2. Add $\frac{1}{2}$ of this length, to get a $1\frac{1}{2}$ top length distance.
3. Determine from the lean how far from the base of the tree the top might land.

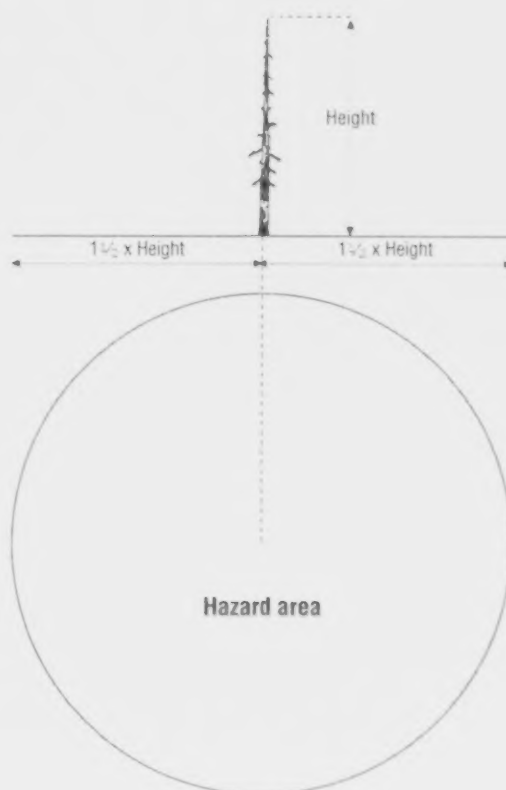


C. Sound tree with lean, hazardous top, on slope

1. Determine the length of top that might dislodge.
2. Add $\frac{1}{2}$ of this length, to get a $1\frac{1}{2}$ top length distance (horizontal distance from tree).
3. From the lean, determine how far from the base of the tree the top might land.
4. On slopes $>30\%$, extend the no-work zone downslope. This distance must be determined on a site-specific basis.

**D. Unsound or hazardous tree, no lean, flat ground**

1. Measure the height of the tree.
2. The no-work zone is a circle around the tree, with a radius of up to $1\frac{1}{2}$ times the height.



E. Unsound or hazardous tree, with lean, flat ground

1. Measure the height of the tree.
2. Add $\frac{1}{2}$ of this length to get a $1\frac{1}{2}$ tree length no-work zone.

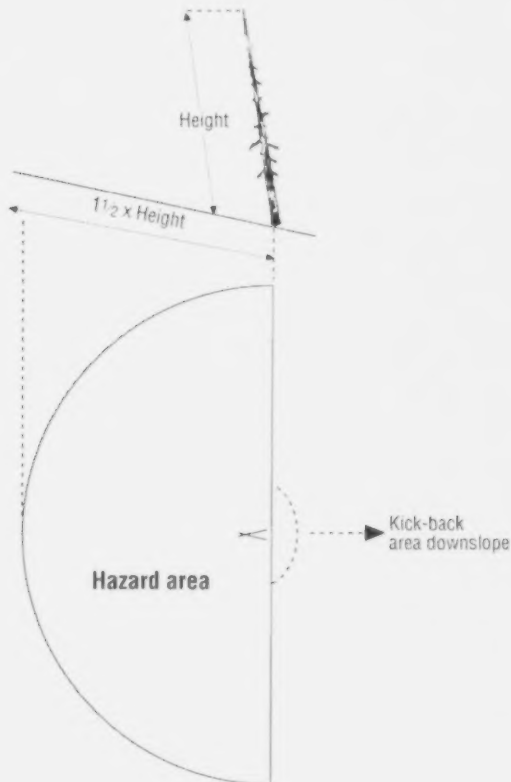


F. Unsound or hazardous tree, with lean, on slope

1. Measure the height of the tree.
2. The no-work zone is a half-circle extending 90° on each side of the lean, with a radius of $1\frac{1}{2}$ times the height of the tree.
3. On slopes $>30\%$, extend the no-work zone downslope. This distance must be determined on a site-specific basis.
4. Trees on a $>30\%$ slope need to be carefully assessed for their wildlife tree value, as the no-work zone will take up a large part of the treatment area.



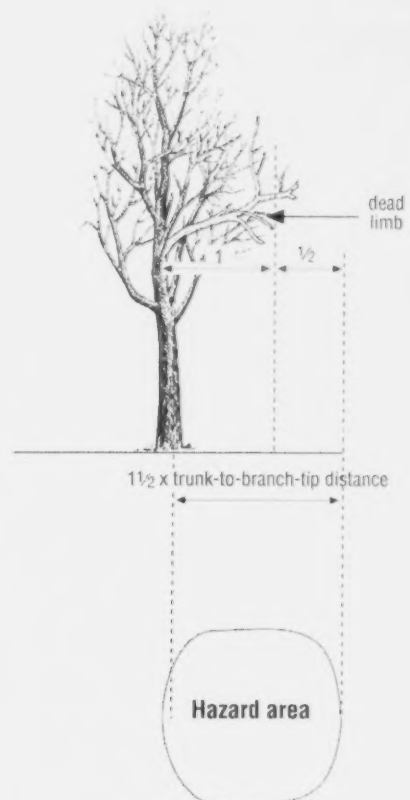
5. Where the tree slopes uphill, the no-work zone should be $1\frac{1}{2}$ times the tree height going upslope.
6. Where the tree slopes uphill, depending on the slope of the hill, a kick-back area will be added on a site-specific basis.



G. Deciduous, sound tree, no lean, defective branches

1. Determine the length of defective limbs that might dislodge.
2. Add $\frac{1}{2}$ of this length to get a $1\frac{1}{2}$ limb length distance.

The $1\frac{1}{2}$ limb length distance must be calculated for all defective limbs on the tree.



Dangerous Trees Along Roadsides

Potentially dangerous trees along and within reach of active roads should be assessed according to the appropriate level of disturbance (i.e., level 1 for light vehicle use and level 2 for heavy vehicle use).

Other factors to consider are:

- amount of lean toward road
- distance from road
- slope toward road
- rooting condition
- any hazardous tree defects (e.g., large dead top) that can reach the road.

Refer to Tables 3 and 3a in order to determine overall danger rating for trees along roadsides.

Large Fire Operations



- Because of the size and relative logistics of fighting large fires, danger tree assessments in these scenarios require careful planning, coordination and communication.
- The requirement for Wildlife Danger Tree assessments is now an integral part of fire operations. Danger tree assessors must be aware of the operations objectives in order to do the most effective job of tree assessment.
- In order to keep crews productive, it can require several assessors in the field each day to ensure enough area is assessed and danger trees removed ahead of the fire crews.
- Large fire operations and documentation require that a seasoned/experienced assessor be in charge of the overall operation (i.e., a "Danger Tree Specialist").
- This "Danger Tree Specialist" will work in conjunction with the Planning Section to ensure that the completion, documentation, mapping and communication of ongoing assessments are produced in a timely manner.

- The “Danger Tree Specialist” will be responsible for ensuring that all assessors working on the project are completing assessments to the required standard. If able, he/she should spend time with each assessor to ensure continuity and consistency of field assessments, documentation and implementation of appropriate safety procedures.
- On a daily basis, the “Danger Tree Specialist” must produce a summary of all areas assessed and pass this information on to the Planning Section.
- The assessment of Danger Trees must be part of the project safety plan.

NOTES

[illegible]

GLOSSARY

<i>biogeoclimatic subzone</i>	A representative class of ecosystem under the influence of the same regional climate. It is associated with a distinct climax (or near-climax) group of plants. For example, the Sub-Boreal Spruce Moist Cool (SBSmk) subzone is characterized by a hybrid spruce-huckleberry-highbush cranberry plant association.
<i>blind conk</i>	Sometimes called swollen knots; are significant indicators of decay. They typically appear as pronounced swellings around knots, and are the result of the tree attempting to heal over an old conk. Often the affected knot and new conk is partially covered by sound wood, which is implied by the term "blind" conk.
<i>build up index (BUI)</i>	A numerical rating of the total amount of fuel available for combustion that combines duff moisture code (DMC) and drought code (DC).
<i>canker</i>	Dead portion of the cambium and bark on a branch or the main stem. Cankers can be raised or sunken and are sometimes surrounded by a raised lip of tissue.
<i>certified assessor</i>	A person who has successfully passed one or more of the "Wildlife/Danger Tree Assessor's Course" modules sponsored by the Wildlife Tree Committee of British Columbia since November 1998, and who holds a valid certificate which signifies this designation.
<i>chlorotic</i>	Yellowing of normally green foliage tissue due to lack of chlorophyll. Usually indicates poor growing conditions or some sort of tree stress (e.g., root disease).
<i>coarse woody debris</i>	Fallen trees and parts of trees on the forest floor.
<i>conk</i>	The fruiting body of a wood decay fungus; bracket-like or reclined or flat on the host or ground, but not a mushroom. Usually woody or leathery in texture.
<i>danger tree</i>	A live or dead tree whose trunk, root system or branches have deteriorated or have been damaged so as to be a potential danger to workers in the vicinity.
<i>drought code (DC)</i>	A numerical rating of the average moisture content of deep, compact, organic layers. This code indicates seasonal drought effects on forest fuels, and the amount of smoldering in deep duff layers and large logs.
<i>duff moisture code (DMC)</i>	Numerical rating of the average moisture content of loosely compacted organic layers of moderate depth. This code indicates fuel consumption in moderate duff layers and medium-sized woody material.
<i>embedded bark</i>	Bark that is pushed inside a developing branch or stem crotch,

	causing visible cracking and a weakened structure.
<i>fire intensity</i>	The rate of heat energy release per unit time per unit length of fire front. Frontal fire intensity is a major determinant of certain fire effects and difficulty of control.
<i>fire perimeter</i>	The entire outer edge or boundary of a fire.
<i>forest activity</i>	Any activity that requires workers to be in the field where they may be in the vicinity of living or dead trees.
<i>live cull</i>	A live tree with some visible external defect such as a broken, dead, or forked top, split or scarred trunk, or fungal conks.
<i>live tree</i>	A living, growing tree with good vigor, no structural problems, and no visible signs of disease or decay.
<i>no-work zone (NWZ)</i>	A flagged area on the ground (must be indicated on site map) where no worker shall enter except to remove hazards. Workers will be informed about no-work zones prior to commencement of work on site. No-work zones are usually 1½ times the length of the tree defect, but can be modified larger or smaller depending on site-specific conditions such as slope or size of adjacent standing timber.
<i>pathogen</i>	A living organism that incites disease in a host.
<i>qualified person</i>	A person experienced in the specified work activity and who, by reason of education, training, experience or a combination thereof, is able to recognize and evaluate hazards associated with trees, with due regard for the anticipated work activity and possible disturbance of the tree(s).
<i>resinosis</i>	An abnormal flow of resin or pitch from conifers, often from the base or lower stem. Resinosis can indicate the presence of tree pathogens or damage.
<i>rust</i>	A disease caused by infection with one of the rust fungi, often producing brown to red spores at some point during the infection.
<i>scaffold branching</i>	Multiple stem and branch attachments characteristic of some deciduous trees. They consist of a system of co-dominant branches and lack a central leader.
<i>sloughing</i>	Starting to separate and eventually falling or breaking away from the tree trunk.
<i>spike top</i>	A dead growth leader (or spike) on a tree which formed after the breakage of the original tree top. Dead spike tops can be hazardous especially if there is evidence of decay or cracking at the point of the old top breakage.
<i>suspect tree</i>	Suspect trees are <i>any live or dead tree with a visible defect which</i>

could cause failure of the tree, either whole or in part, for the applicable level of disturbance. Suspect trees require a visual inspection as well as a site assessment by a qualified person or a certified danger tree assessor, in order to determine whether they are dangerous for a particular level of disturbance/type of work activity.

veteran tree

A tree which is significantly older than the trees of the main canopy (usually 150 years of age or greater). The tree may have survived one or more fires as evidenced by fire scars. Veteran trees are usually isolated in distribution and often extend well above the main tree canopy. Because of their large size, they usually provide valuable wildlife tree habitat.

wildlife tree

A standing dead or live tree with special characteristics that provide valuable habitat for the conservation or enhancement of wildlife.

Wildlife Tree Committee

A committee organized in 1985 to find ways of maintaining wildlife tree habitat in forestry activities without endangering the safety of forest workers.

work area

Includes area of actual fire fighting within the fire perimeter and adjacent areas by 1½ or more tree lengths, as well as access roads, evacuation routes, helicopter landing areas, rest areas, staging areas, marshalling points, and incident facilities.

work place

Includes all locations where a worker is or is likely to be engaged in work activities. In the case of forest workers, this includes locations where they are exposed to trees.

TABLE 1
FBP System
Fuel types

Group	Identifier	Description
Coniferous	C-1	Spruce-lichen woodland
	C-2	Boreal spruce
	C-3	Mature jack or lodgepole pine
	C-4	Immature jack or lodgepole pine
	C-5	Red and white pine
	C-6	Conifer plantation
	C-7	Ponderosa pine-Douglas-fir
Deciduous	D-1	Leafless aspen
Mixedwood*	M-1	Boreal mixedwood-leafless
	M-2	Boreal mixedwood-green
	M-3	Dead balsam fir mixedwood-leafless
	M-4	Dead balsam fir mixedwood-green
Slash	S-1	Jack or lodgepole pine slash
	S-2	White spruce-balsam slash
	S-3	Coastal cedar-hemlock-Douglas-fir slash
Open	O-1a	Matted grass
	O-1b	Standing grass

* M-1 and M-2 are transitional between C-2 and D-1

APPENDIX 1 – HABITAT ECOLOGY

WHAT CONSTITUTES GOOD WILDLIFE TREE HABITAT?

When considering the needs of wildlife it is important to recognize that all trees are not equal in value. Given the large number of wildlife tree-dependent species and wide range of wildlife uses of these trees, there can be no simple system for determining which trees provide the best habitat for wildlife. The most significant indicators of wildlife tree quality are height and diameter, decay stage, location, distribution and cause of death.

Wildlife Tree Characteristics:

- greater than 15 m in height preferable
- greater than 30 cm dbh preferable (interior)
- greater than 70 cm dbh preferable (coastal)
- decay classes 2–6 conifers and 2–4 hardwoods most valuable
- windfirm, sound root system
- broken top
- some large branches
- some intact bark with space behind loose bark
- nest cavities, feeding excavations
- some evidence of decay (visible fungal conks or cankers)



Height and diameter

Generally, the larger the diameter of a wildlife tree, the greater the variety of species that benefit from it. Most wildlife tree-dependent species prefer tall, larger diameter trees because they offer greater security. A tree with a large trunk provides the potential for a spacious cavity with strong walls. Thick-walled cavities protect their occupants against predators and inclement weather. Large dead trees usually remain standing for many years, providing wildlife habitat for a much longer time than small trees, which fall soon after they die. Large trees are also important for open nesters such as Bald Eagles, Ospreys, and some hawks and owls.

Decay stage

Each stage in the decay process has particular value to certain wildlife species. The earlier the stage of decay, the harder the wood will be. Strong excavators (woodpeckers) usually nest and roost in "hard" trees, while weak excavators (nuthatches, chickadees) prefer "soft" trees. Soft trees also provide the substrate for the numerous species of invertebrates that comprise the food supply of many wildlife species. "Hard" trees which still have branches provide good hunting perches for predatory birds. They also have great future value since most of them, except for those that are fire hardened, will eventually become soft. Fire hardened wildlife trees are not usually suitable for excavating nest holes, but they are often good feeding sites, especially in the first 1-2 years after the fire.

Location

Animals that require dead trees for nesting, denning or feeding usually need live trees nearby for protective cover and foraging habitat. Nest trees of primary cavity excavators (PCEs) are often found at the edge of cutblocks, roads or natural forest gaps. The species composition and structure of the surrounding plant community also influence wildlife use of trees. Some wildlife species such as kestrels, flycatchers and bluebirds require trees surrounded by low or early-seral vegetation (grass-forb, shrub-seedling, pole-sapling) which can function as hunting perches and harbour prey species. Woodpeckers, owls, Vaux's Swifts and others are dependent on the taller tree communities that develop later (young, mature or old-growth). Wildlife trees adjacent to water bodies are important for cavity-nesting ducks, Great Blue Herons, Ospreys, Bald Eagles and Belted Kingfishers. The preferred topographic location of roost trees may vary from season to season.

Class 2 Trees

Definition

Class 2 trees are live trees with a **visible defect which directly compromises the structural strength of the tree**. This will (or has the potential to) cause whole or partial breakage or uprooting of the tree, or a portion thereof. Consequently, these will be defects which are almost always associated with internal decay or some form of stem or root system damage. The **presence of the following defects on live trees** can be used to differentiate Class 2 trees from Class 1 trees:

- Fungal conks
- Tree cavities (natural or created by wildlife)
- External stem scars (usually will be caused by mechanical or fire damage, or the breakage of large limbs)
- Stem cracks/splits (must have associated decay; not a simple dry check):
 - This condition will include "included bark" (cracking/splitting) at live stem fork unions, and is most common in large deciduous trees.
 - **NOTE:** if you cannot clearly see the crack and therefore are uncertain whether there is associated decay, then categorize this as a defect
- Dead tops (any size — either as a dead spike, dead fork, or dead multiple top)
- Broken tops
- Large dead limbs (> 10 cm diameter)
- Damaged roots (mechanical, fire or disease)
- Excessive lean (>30 %) **AND** damaged/diseased roots or a poor anchoring soil substrate
- Large canker face (>50 % of tree circumference)
- Unusual stem swellings (may indicate hidden decay)

Class 1 trees are live, healthy trees and are free of the above defects. Minor defects such as stem scrapes, bark scorching, small dead limbs, live forks and live multiple tops, will usually have no associated decay or loss of columnar shell thickness, and will therefore NOT reduce the tree's structural strength NOR present a worker safety hazard.

The ability to distinguish between Class 1 and Class 2 trees is most important when working under Level 4 disturbance. At this level (as per the WDTAC guidelines), all Class 1 trees, and Class 2 cedars with low failure potential defects, are rated as safe. In addition, Class 2 trees with **no structural defects** are also rated as safe for Level 4. This latter criterion is a bit of an oxymoron — **Class 2 trees should be defined as per the above descriptors.**

ONLY trees which have been recently wind- or snow-snapped (i.e., lost their top, but have no associated decay and still have green foliage), or are partially defoliated or dying back from insect attack, can be described as "Class 2 with no defects".

APPENDIX 2 – COMMON PATHOGENS OF TREES IN BRITISH COLUMBIA

COMMON PATHOGENS OF TREES IN BRITISH COLUMBIA

	Common/Scientific name	Hosts	Notes
REGION: North Coast —Bella Coola is the approximate southern limit			
Diseases			
Stem diseases	Brown Stringy Trunk Rot <i>Echinodontium tinctorium</i>	Mountain and western hemlock; amabilis, grand and subalpine fir; white and Sitka spruce Douglas-fir and western redcedar	High elevations only on coast, Not found on Queen Charlottes
	Red Ring Rot <i>Phellinus pini</i>	Mountain and western hemlock; amabilis, grand and subalpine fir; black, white, Engelmann and Sitka spruce; jack, lodgepole, ponderosa and western white pine; Douglas-fir, yellow-cedar, larch and western redcedar	Throughout the host range
	Brown Crumbly Rot <i>Fomitopsis pinicola</i>	Occurs on a wide range of hosts, including most conifers. It has not been reported on yellow-cedar, black spruce or maple in B.C. Red alder, paper birch, aspen and cottonwood	Is one of the most frequently occurring decay fungi in B.C. Is very common on dead trees but can cause considerable damage to live trees
	Hemlock Dwarf Mistletoe <i>Arceuthobium tsugense</i>	Hemlock	Throughout the host range
Root diseases	Annosus Root Rot <i>Heterobasidion annosum</i>	Occurs on a wide variety of coniferous and broad-leaved species; western hemlock, amabilis and grand fir, white and Sitka spruce, lodgepole pine, Douglas-fir, western redcedar, bigleaf maple, and alder	Affects trees west of the Coast Mountains
	Tomentosus Root Rot <i>Inonotus tomentosus</i>	Sitka and white spruce	Mainly in ICH (Interior Cedar Hemlock) zone
Insects			
Bark beetles	Western Balsam Bark Beetle <i>Dryocoetes confusus</i>	Subalpine fir	Throughout the host range.
Defoliators	Tent Caterpillar <i>Malacosoma disstria</i>	Trembling aspen	Throughout the host range
	Western Blackheaded Budworm <i>Acleris gloverana</i>	Western hemlock, amabilis fir, Sitka spruce	Throughout the host range
	Green Striped Forest Looper <i>Melanolophia imitheia</i>	Western hemlock	Throughout host range

	Common/Scientific name	Hosts	Notes
REGION: South Coast —Bella Coola is the approximate northern limit			
Diseases			
Stem diseases	Brown Stringy Trunk Rot <i>Echinodontium tinctorium</i>	Mountain and western hemlock; amabilis, grand and subalpine fir; white and Sitka spruce Douglas-fir and western redcedar	High elevations only on coast
	Red Ring Rot <i>Phellinus pini</i>	Mountain and western hemlock; amabilis, grand and subalpine fir; black, white, Engelmann and Sitka spruce; jack, lodgepole, ponderosa and western white pine; Douglas-fir, yellow-cedar, larch and western redcedar	Throughout the host range
	Aspen Trunk Rot <i>Phellinus tremulae</i>	Only on trembling aspen	Found where trembling aspen occurs on the south coast
	Brown Crumbly Rot <i>Fomitopsis pinicola</i>	Occurs on a wide range of hosts, including most conifers; has not been reported on yellow-cedar, black spruce or maple in B.C. Red alder, paper birch, aspen and cottonwood	Is one of the most frequently occurring decay fungi in B.C. Is very common on dead trees but can cause considerable damage to live trees
	Hemlock dwarf mistletoe <i>Arceuthobium tsugense</i>	Hemlock	Throughout the host range
Root diseases	Armillaria Root Rot <i>Armillaria ostoyae</i>	All native conifer species are susceptible except mountain hemlock	Throughout the host range south of 57° latitude
	Annosus Root Rot <i>Heterobasidion annosum</i>	Occurs on a wide variety of coniferous and broad-leaved species: western hemlock, amabilis and grand fir, white and Sitka spruce, lodgepole pine, Douglas-fir, western redcedar, bigleaf maple, and alder	Affects trees west of the Coast Mountains
	Laminated Root Rot <i>Phellinus weirii</i>	Douglas-fir; grand, Pacific silver and white firs; mountain hemlock	Throughout the host range, but most damaging to Douglas-fir in coastal stands
	Blackstain root disease <i>Leptographium wageneri</i>	Douglas-fir	Throughout the host range
Insects			
Bark beetles	Douglas-fir Beetle <i>Dendroctonus pseudotsugae</i>	Douglas-fir	Mainly eastern Vancouver Island and lower mainland north to host range
Defoliators	Western Hemlock Looper <i>Lambdina fuscicollis lugubrosa</i>	Western hemlock	Occurs primarily south of latitude 56° along the coast
	Western Blackheaded Budworm <i>Acleris gloverana</i>	Western hemlock; amabilis fir; Sitka spruce	Throughout the host range along the south coast
	Western Spruce Budworm <i>Choristoneura occidentalis</i>	Douglas-fir; true firs; spruce	Throughout the host range along the south coast

Common/Scientific name		Hosts	Notes
REGION: North and Central Interior —from approximately Williams Lake and north			
Diseases			
Stem diseases	Brown Stringy Trunk Rot <i>Echinodontium tinctorium</i>	Mountain and western hemlock; amabilis, grand and subalpine fir; white and Sitka spruce, Douglas-fir and western redcedar	Main cause of heart rot in mature hemlock and true firs
	Red Ring Rot <i>Phellinus pini</i>	Mountain and western hemlock; amabilis, grand and subalpine fir; black, white, Engelmann and Sitka spruce; jack, lodgepole, ponderosa and western white pine; Douglas-fir, yellow-cedar, larch and western redcedar	Throughout the host range
	Aspen Trunk Rot <i>Phellinus tremulae</i>	Only on trembling aspen	Found where trembling aspen occurs
	White Spongy Trunk Rot <i>Fomes fomentarius</i>	White birch	Throughout host range
	Lodgepole Pine Dwarf Mistletoe <i>Arceuthobium americanum</i>	Lodgepole pine	Throughout host range
Root diseases	Tomentosus Root Rot <i>Inonotus tomentosus</i>	Amabilis and subalpine fir; Engelmann, black and white spruce; lodgepole, ponderosa and white bark pine; Douglas-fir; western hemlock; larch	Found in spruce-pine forests, particularly spruce stands in northern interior
Insects			
Bark beetles	Mountain Pine Beetle <i>Dendroctonus ponderosae</i>	All pines, especially lodgepole	Throughout the host range
	Spruce Beetle <i>Dendroctonus rufipennis</i>	Engelmann, white and Sitka spruce	Throughout the host range
	Western Balsam Bark Beetle <i>Dryocoetes confusus</i>	Subalpine fir	Throughout the host range, on the east of the Coast Mountains
Defoliators	Forest Tent Caterpillar <i>Malacosoma disstria</i>	Trembling aspen	Throughout the host range
	Large Aspen Tortrix <i>Choristoneura conflictana</i>	Trembling aspen	Throughout host range
	2-year Cycle Budworm <i>Choristoneura biennis</i>	White spruce; subalpine fir	Sub-Boreal Spruce zone McBride, Hazelton and north
	Western Blackheaded Budworm <i>Acleris gloverana</i>	Subalpine fir; white spruce	Throughout the host range
	Eastern Spruce Budworm <i>Choristoneura fumiferana</i>	Subalpine fir; white spruce	Fort Nelson area

Common/Scientific name		Hosts	Notes
REGION: South Interior —from approximately Williams Lake and south			
Diseases			
Stem diseases	Brown Stringy Trunk Rot <i>Echinodontium tinctorium</i>	Mountain and western hemlock; grand and subalpine fir; white spruce; Douglas-fir; western redcedar	Interior wet belt. Main cause of heart rot in mature hemlock and true firs
	Red Ring Rot <i>Phellinus pini</i>	Mountain and western hemlock; grand and subalpine fir; black, white, Engelmann and Sitka spruce; jack, lodgepole, ponderosa and western white pine; Douglas-fir; larch; western redcedar	Throughout the host range
	Lodgepole Pine Dwarf Mistletoe <i>Arceuthobium americanum</i>	Lodgepole pine	Throughout host range
	Aspen Trunk Rot <i>Phellinus tremulae</i>	Only on trembling aspen occurs	Found where trembling aspen
	Brown Crumbly Rot <i>Fomitopsis pinicola</i>	Occurs on a wide range of hosts, including most conifers; has not been reported on yellow-cedar, black spruce or maple in B.C. Red alder, paper birch, aspen; cottonwood	One of the most frequently occurring decay fungi in B.C. Very common on dead trees but can cause considerable damage to live trees occurs
Root diseases	White Spongy Trunk Rot <i>Fomes fomentarius</i>	White birch	Throughout host range
	Armillaria Root Rot <i>Armillaria ostoyae</i>	All native conifer species are susceptible except mountain hemlock	Most prevalent in south interior
	Tomentosus Root Rot <i>Inonotus tomentosus</i>	Amabilis and subalpine fir; Engelmann, black and white spruce; lodgepole, ponderosa and white bark pine; Douglas fir, western hemlock; larch	Less common than in north interior. Usually in moist spruce stands at high elevations
	Laminated Root Rot <i>Phellinus weirii</i>	Douglas-fir, grand fir; western hemlock	Rare, east of Purcell Mountains
	Blackstain root disease <i>Leptographium wageneri</i>	Douglas-fir	Primarily West Kootenays
Insects			
Bark beetles	Mountain Pine Beetle <i>Dendroctonus ponderosae</i>	All pines, especially lodgepole	Throughout the host range.
	Spruce Beetle <i>Dendroctonus rufipennis</i>	Engelmann and white spruce	Throughout the host range
	Western Balsam Bark Beetle <i>Dryocoetes confusus</i>	Subalpine fir	Throughout the host range
Defoliators	2-year Cycle Budworm <i>Christoneura biennis</i>	Engelmann spruce; subalpine fir	High elevation in southeastern B.C.
	Forest Tent Caterpillar <i>Malacosoma disstria</i>	Trembling aspen	Throughout the host range.
	Western Hemlock Looper <i>Lambdina fiscellaria lugubrosa</i>	Western hemlock	Primarily in the interior wet belt
	Western Spruce Budworm <i>Choristoneura occidentalis</i>	Douglas-fir; true firs; spruce	Okanagan and West Kootenays
	Douglas-fir Tussock Moth <i>Orgyia pseudotsugata</i>	Douglas-fir	Throughout Okanagan and drier areas of West Kootenays

APPENDIX 3 – A DISCUSSION OF LIABILITY AND DANGEROUS TREE ASSESSMENT

A DISCUSSION OF LIABILITY AND DANGEROUS TREE ASSESSMENT

"Duty of care" is the legal responsibility of the landowner or someone acting on their behalf (i.e., forest manager, park manager) to reasonably ensure the safety of persons working on or using that property. The duty of care is often established by various Acts or policies such as the *Occupiers Liability Act*. The Duty of Care invokes a certain standard of conduct called the "standard of care." Standard of care is defined as the best available guidelines and practices used to fulfill a particular "duty of care." Standard of care is recognized according to established procedures at an accepted level of standards. The Wildlife/Danger Tree Assessment process and associated course (WDTAC) is recognized in B.C. as the current "standard of care" relative to the determination of tree danger and hazards.

Relative to persons who might be assessing trees for work activities or other situations, as long as these are qualified persons (i.e., they have successfully completed standardized training in dangerous tree assessment or have demonstrated knowledge and experience of the work activity and hazards involved) who have applied the accepted standard of care for dangerous tree assessment (i.e., the WDTAC process), and have done so with due diligence (i.e., they were not negligent in following the accepted procedures or techniques), then they should not be held liable if a subsequent accident were to happen relative to a previously assessed tree. The assessment by said person would be viewed as consistent with "what a reasonable and prudent person (i.e., trained with similar qualifications) would have concluded under similar circumstances." Therefore, there would be no case for liability since **liability has to be proven, usually by showing that some sort of negligence was involved**. Generally, *liability hinges on whether or not there was a duty of care to be exercised, and if so, whether or not it was negligently implemented* (i.e., the accepted standard of care was not adhered to). In other words, was the person "**duly diligent**" in performing the work required?

"Due diligence" is the process of performing a task to the best of one's knowledge, ability and, as far as reasonably possible, according to the prescribed procedures.

When determining whether "due diligence" was taken, the following will be considered:

- Who was involved? A combination of the following determine one's capability for completing the particular task:
 - ~ knowledge
 - ~ training
 - ~ experience
 - ~ skills
- What was done?
 - ~ was the work done as well as others would do it? Done according to accepted procedures?
 - ~ what is required by regulation for the work done?

APPENDIX 4 – SAMPLE DANGEROUS TREE ASSESSMENT DOCUMENTATION

SAMPLE DANGER TREE ASSESSMENT DATA FORM

1. Fire Name/Number _____
2. Assessor's Name(s) _____
3. Assessor's Wildfire #(s) _____
4. Date of Assessment _____
5. Activity _____
6. Level of Disturbance(s) _____
7. Fuel Type/BUI _____ / _____
8. Site Assessment Overview - general comments

9. Map Attached Yes _____ No _____
Hand Drawn _____ Scaled Map _____

10. Standards for Assessment - Please tick off appropriate comments

- _____ The Wildfire Danger Tree Assessment was completed as per the standards set out in the Wildfire Danger Tree Assessor's Course.
- _____ The assessed area is a minimum of 1.5 tree lengths from the guard on the fire side.
- _____ The entire area identified on the attached map was assessed.
- _____ No assessment was completed on the 'green' side of the guard, this area is a No Work Zone at this time.
- _____ All identified dangerous trees in the area on the attached map were felled or placed in No Work Zones.
- _____ The identified dangerous trees were all marked but falling was not complete in the identified area.
- _____ No Work Zone flagging used is _____
- _____ Danger Tree flagging used is _____
- _____
- _____
- _____
- _____

_____ The area identified on the attached map is fully assessed, the dangerous trees have been managed for, and the area is considered safe for fire crews to work in on the _____ day of _____ at _____ hours for the Level of Disturbance stated in Line 5. **OR**

_____ All danger trees have not yet been managed for in the assessment area and the area is not yet considered safe for fire crews to work in.

11. Other Site Specific Information

12. Information passed on to:

Name/Title _____
Date _____
Time _____

Assessor's Signature

APPENDIX 5 – DANGER TREE MARKING/FLAGGING PROTOCOL

Danger Tree Marking/Flagging Protocol in Wildland Fire Operations

To ensure work areas on fire situations can be easily identified on the ground relative to their status concerning wildlife/danger tree assessment and hence worker safety, the following procedures are suggested. **However, it is most important that whatever flagging or paint colours are used, that these be communicated to all workers on site.**

Flagging Colours

No Flagging or paint present: Only applicable to areas open for Very Low Risk (VLR) activities with appropriate safety/work procedures implemented. Heads-up, be aware of dangerous tree defects.

Orange: Indicates area has been assessed, but danger trees have NOT yet been removed. Assessors initials, date and time of assessment, and next assessment date should be on an appropriate number of ribbons and maps with updates undertaken as appropriate. The LOD level should also be indicated on flagging and accompanying maps.

Yellow: Indicates no-work-zone (NWZ) around dangerous areas or individual trees/defects that have been assessed as dangerous.

Lime Green (Safe Tree/Area): To be used as an indicator that the area has been felled out (i.e., danger trees have been removed or NWZs in place around some individual trees) by a qualified person. Therefore, **this area is now safe for workers**. Can also be used on high value individual wildlife trees that have been assessed as Safe and which are to be retained.

Paint

Where possible, use same paint colour as the flagging colours described above.

Use paint for marking danger trees with 'D' on three sides (fluorescent lime green or blue recommended). When paint is in short supply, a stripe can be painted around dangerous trees.



Paint can also be used to place an arrow on the tree to identify hung-up limbs and tops and install a **no work zone** to accommodate the hazard. This will help to minimize fuel loading, as the tree can remain standing. Paint is also useful for making traffic signs such as 'warning', 'no-entry' and 'danger tree removal'.

Please note that paint should only be used in situations where flagging is not available. Flagging is easily removed, changed and/or updated; paint is not as amenable to change.

Communication

Ideally, the assessors will be working in conjunction with the fallers and will provide a detailed map of the areas assessed and felled.

Each assessor and or faller will hand in the maps, field cards and assessment forms to the Danger Tree Specialist at the end of every day.

The danger tree removal process and all records must be accessible and retrievable. This will give all personnel an accurate and up-to-date record of what has been assessed and felled, when and where it was done, and when it needs to be reassessed.

If workers are scheduled to work in an area subsequent to that area being assessed, and the appropriate safety procedures have been implemented (i.e., danger trees felled or placed in NWZs), then all assessment information (i.e., marking procedures, locations of NWZs, locations of assessed areas) **must be clearly communicated to all workers in the field PRIOR to them beginning their proposed work.**

APPENDIX 6 – SAMPLE DANGER TREE ASSESSMENT MAPS

N50451 DTA

Map 1: Level of Disturbance

09-06 1600 hrs

Stagi 11 / guéris



Level 1

Level 3

Level 4
(Strategic Areas)

N50451 DTA

Map 2: Assessed Areas

09-06 1600 hrs



Fire guards
DTA'd 100 feet
in

Access roads
DTA'd 1 tree
length

NOTE: only
new/ DTA/DSF
areas shown.

APPENDIX 7 – OCCUPATIONAL SAFE WORK STANDARD #1

Operational Safe Work Standards**#1****WILDFIRE DANGEROUS TREES**

Applies to	Personnel employed by or contracted with the Forest Service and involved in ground fire suppression operations.
Purpose	To provide a safe work environment and to meet Workers' Compensation Occupational Health & Safety Regulations. The Forest Service will have Safe Work Standards that constitute safe methods, conditions and requirements for workers involved in fire line suppression operations.
Critical Safety Statements	In wildfire operations, if a worker will be put at undue risk of being injured by a suspect or potentially dangerous tree, the tree must be removed <u>or</u> assessed by a Certified Danger Tree Assessor who determines whether the tree is safe or dangerous and manages it in accordance with the established practices.
Exceptions	In Very Low Risk activities (site survey, reconnaissance, tree marking, boundary and fire guard/control layout, establishing hose lays in green unburned areas, burning off, road travel with light vehicles such as ATV's, pickups <-5500 kg GVWR in green unburned areas) a formal Dangerous tree assessment is NOT required. Workers need to keep a "heads up" and stay away from any obvious dangerous trees and overhead tree hazards (insecurely lodged trees, hanging top or limbs). The use of spotters to watch suspect or potentially dangerous trees in order to allow other workers to carry out fire suppression actions may be utilized as long as the work carried out is critical to controlling the fire, there is no other practical alternative safety procedure, and the use of spotters is for a short duration only. If this practice is to be employed, then it is essential that all workers on site are aware of the procedures to be used and appropriate action required if a tree appears in any way to be posing a threat of injury to workers on-site at that time. All procedures must be documented and placed on the appropriate incident file. If conditions call for an alternate safe work procedure from these standards, an amending written practice will be developed to address the specific situation and ensure the safety of personnel. The appropriate Fire Centre Manager or the Director must approve this practice.
Contact	Mel Dunleavey: mcl.dunleavey@gems3.gov.bc.ca or (250) 992-2144
DEFINITION(s)	
Dangerous Tree	Any tree that is hazardous to workers because of location or lean, physical damage, overhead hazards, deterioration of limbs, stem or root system, or a combination of these.
Certified Danger Tree Assessor	A person who has successfully passed one or more of the "Wildlife/Danger Tree Assessor's course" modules sponsored by the Wildlife Tree Committee of British Columbia since November 1998, and who holds a valid certificate which signifies this designation. For wildfire applications the assessor must hold a valid "wildfire module" certificate.

PROCEDURES

Operational Safe Work Standards

#1

Hazards

During the initial site survey and fire attack planning process, the types and locations of potential hazards (including potentially dangerous trees) will be disclosed to workers. Appropriate action will be taken to avoid or mitigate hazards.

Wind Influence

Workers must be aware of wind conditions and the influence of wind on tree stability. Strong winds increase the potential of trees failing. Potentially dangerous trees within reach of work areas must be removed or managed by a certified assessor who determines whether the tree is safe or dangerous, and manages it in accordance with the established practices. If wind conditions become strong enough (i.e., winds set whole trees in motion and cause branches to break and fly in the air, or walking is impeded by the wind), workers should consider leaving the work area and go to a safe refuge.

Assessment

A certified danger tree assessor will rate the tree as:

Safe

The tree can be left standing (i.e., less than 50% stem damage to coniferous trees or less than 50% of roots severed, burned, or damaged by heavy equipment, fire, decay or any combination of these.)

Dangerous

The tree must be removed, or remove dangerous part of the tree (e.g., hazardous limb), or a No Work Zone must be established and flagged around it.

Assessment for dangerous trees is required for the active work area, the perimeter of the work area (within 1 ½ tree lengths or greater, depending on site factors such as slope), and other locations including but not limited to rest areas, staging areas, and access and egress routes.

Communication

Once an assessment is complete, the following details must be communicated to the workers in the area:

1. The location of the areas that have been assessed for dangerous trees;
2. The marking method used for trees assessed as "dangerous" or "safe";
3. The location and marking method used for No Work Zones;
4. The type of work activity the area has been assessed for.

Re-assessment

Re-assessment of previously assessed areas should occur if:

1. Buildup Index values are above the established thresholds and there is continuous active burning within the area of work, or
2. More than three days with continuous burning have passed since the last assessment, or
3. The work activity in the area creates more disturbance than what the area was originally assessed for.

Falling Danger Trees

No person will fall dangerous trees unless they have formal training in falling and have demonstrated competence in falling dangerous trees. No person will blast dangerous trees unless they have formal blasting training.

Machine-constructed fire guards do not normally require pre-falling of Dangerous Trees because of short exposure time and Roll Over Protection Systems used on heavy equipment.

Operational Safe Work Standards**#1****FAQ's**

- Q1. Do all areas of a fire, where there will be workers, need to be assessed?
A1. No, but to comply with WCB Regs. either all suspect trees are felled or a dangerous tree assessor must assess the area.
- Q2. Requiring approval of work procedure exceptions by a Fire Centre Manager or Director ties the Incident Commander's hands.
A2. It needn't, a documented phone call to the Fire Centre Manager could serve as the approval. The Fire Center Manager could follow-up in writing.
- Q3. Can "Forestry Module" Wildlife Danger Tree Assessors conduct Danger Tree Assessments on Wildfires?
A3. No - WCB will not recognize assessments conducted on a wildfire by Forestry Wildlife Danger Tree Assessors. There are significant differences in the process and tree defect ratings and therefore would not be considered the standard of care on a wildfire. These assessors can take a 1 day update to be considered qualified to do dangerous tree assessments on a wildfire.

Original signed by
Peter Fuglem
Director Protection Branch

May 10, 2002
Updated March 2004

Director's Approving Signature

Approval Date

**APPENDIX 8 – ALTERNATE SAFE WORK
PROCEDURE FOR DECAY DEFECTS ON TREMBLING ASPEN**

Alternate Safe Work Procedures for Decay Defects on Trembling Aspen

Rationale

Trembling aspen (*Populus tremuloides*) is one of the most common deciduous trees which occurs throughout most of interior British Columbia. Where it occurs, it is perhaps the most valuable wildlife tree for cavity excavating birds because of its propensity to develop heart rot decay as a live tree, relatively soon in its life span. In most cases this heart rot is caused by the fungi *Phellinus tremulae*, which is restricted to the heartwood of the tree and is often successfully compartmentalized by the tree. Consequently, depending on the diameter and vigour of the tree, the internal decay is restricted to the heartwood, with the tree developing a sound outer shell of later heartwood and sapwood. The result is a live tree which can often exhibit numerous fruiting bodies of *P. tremulae* (brownish-gray conks are usually visible just below branch stubs), yet have enough sound outer wood in the stem cross-section to provide columnar strength to the bole of the tree (i.e., the minimum required shell thickness is > 30% of the tree radius). Trees in this condition make excellent nest sites for cavity excavating birds, and while they are still alive, often do not suffer stem breakage.

Related Danger Tree Assessment Guidelines

According to the tree failure criteria described in the *Wildland Fire Safety Module*, the presence of "...any heart rot fungi" found on broad-leaved deciduous trees results in a "Dangerous" rating for those trees, under Level 2-4 work activities. Most mature aspen have *P. tremulae* conks or blind conks --- this means that these trees would automatically get a "D" rating if there is exposure to workers (except for Level 1 work activities). In some areas of the province where aspen is abundant, this may mean that an undue number of live and/or minimally damaged aspen would be rated "D" for Level 2-4 work activities --- this would result in an unnecessary amount of tree felling and subsequent fuel loading in these situations, as well as a loss of wildlife habitat. An alternate job safety procedure is recommended for aspen, as follows.

Alternate Job Safety Procedure for Trembling Aspen (Level 2-4 work activities)

1. Conduct a site assessment overview in order to determine the general size and condition of aspen in the work area.
2. Look for visible conks and blind conks on tree trunks (usually seen as rough textured, blackish swellings at the base of branch stubs)
3. Look for aspen trees which have broken or snapped. If trees have sufficient decay to be a safety hazard (i.e., they have insufficient sound shell), then it is very likely that you will observe some broken and snapped trees, and trees with extensive woodpecker nest holes along the trunk.
4. If you do not see many broken or snapped aspen (with or without fire damage), then conclude that live standing aspen with NO OTHER DAMAGE other than visible conks, can be declared "Safe" to work around during the period of the work activity (subject to 72 hour reassessment period as per all trees).
5. Document your observations of aspen based on the site assessment overview
6. Determine and document marking procedures for aspen. If live aspen with conks are generally not breaking in the stand, then you will likely NOT have to mark aspen which have visible conks, but no other damage.
7. The above 6 steps **ONLY apply to LIVE** aspen with visible conks or blind conks, AND which do NOT have other damage. Trees with other damage (e.g., fire scarring, dead tops, damaged roots, etc.) must be assessed according to Table 3, 3A or 4 from the *Wildland Fire Safety Module* course manual, and dealt with accordingly.

APPENDIX 9 – WHERE TO GET RESOURCE MATERIALS

Where to Get Resource Materials

The following resource materials and contacts can be obtained as follows:

- FS502b, FS502c and FS502c cards - contact Ministry of Forests, Protection Branch, Victoria BC (250) 387-5965
- *Tree Book - Learning to Recognize Trees of British Columbia* - contact Crown Publications, Victoria, BC (250) 386-4636
- *Common Tree Diseases of British Columbia* - contact Natural Resources Canada, Pacific Forestry Centre, Victoria, BC (250) 363-0600
- To enroll in a *Wildlife/Danger Tree Assessor's Course* Module - contact University of Northern British Columbia, Dept. of Continuing Education, Prince George, BC (250) 960-5982

